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$$\begin{aligned}
& + \frac{1}{360} \int_0^{4\pi} (4\sin^2\theta + 2\cos^2\theta + 42\sin\theta\cos\theta - 12\sin\theta\cos^3\theta - 20\sin^3\theta\cos\theta + \sec^8\theta\csc^2\theta \\
& \quad + 6\sec^7\theta\csc\theta - 60\sec^2\theta\csc\theta - 6\sec\theta\csc\theta - 36\tan\theta + 10\tan^2\theta \\
& \quad + 20\tan^3\theta - \cot^2\theta + 20\csc^2\theta + 123\sec^2\theta - 50\tan\theta\sec^2\theta + 5\tan^2\theta\sec^2\theta \\
& \quad + 14\tan^3\theta\sec^2\theta - 103\tan^4\theta\sec^2\theta + 186\tan^5\theta\sec^2\theta - 236\tan^6\theta\sec^2\theta \\
& \quad + 192\tan^7\theta\sec^2\theta - 60\tan^8\theta\sec^2\theta + 36\tan^9\theta\sec^2\theta + 84\tan^{10}\theta\sec^2\theta \\
& \quad + 45\tan^{12}\theta\sec^2\theta) d\theta = \frac{1}{400} \frac{9}{4} \frac{9}{4} \frac{7}{4} \frac{7}{4} - \frac{1}{144} \log 2.
\end{aligned}$$

$$3p' = \frac{3}{4} \frac{5}{0} \frac{7}{0} \frac{8}{4} \frac{1}{0} - \frac{1}{8} \log 2, \quad p = 1 - 3p' = \frac{1}{4} \frac{1}{8} \log 2 + \frac{4}{0} \frac{0}{0} \frac{6}{4} \frac{1}{0} \frac{9}{0}. \quad \therefore p = .260292.$$

124. Proposed by F. P. MATZ, Sc. D., Ph. D., Professor of Mathematics and Astronomy in Defiance College, Defiance, Ohio.

Find the average area of a spherical polygon of  $n=6$  sides.

No solution of this problem has been received.

### MISCELLANEOUS.

118. Proposed by O. W. ANTHONY, New York, N. Y.

If  $f$  is determined by the equation  $f(\mu\nu) = f(\mu)f^{-1}(\nu) + f(\nu)f^{-1}(\mu)$ , where  $f^{-1}$  is the inverse of  $f$ , show that  $f[(2)^\mu] = \frac{k^{\mu+1}}{2^{\mu+1}}$ , where  $k$  is a constant.

Solution by G. B. M. ZERR, A. M., Ph.D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa.

$$f(\mu\nu) = ff^{-1}(\mu\nu) + ff^{-1}(\mu\nu), \text{ but } ff^{-1} = 1. \quad \therefore f(\mu\nu) = 2(\mu\nu). \quad \therefore f = 2.$$

$$\therefore (2)^\mu = (f)^\mu \text{ or } f[(2)^\mu] = (f)^\mu + 1 = (2)^{\mu+1}.$$

$$\therefore f[(2)^\mu] = (\frac{1}{2}k)^{\mu+1}, \text{ where } k=4.$$

119. Proposed by L. C. WALKER, A. M., Graduate Student, Leland Stanford Jr. University, Cal.

Show how to determine the illumination at any point of the surface of the water at the bottom of a deep well, due to the light from the sky.

A solution of this problem appeared in the November number. The problem was incorrectly numbered. Ed.

120. Proposed by W. J. GREENSTREET, M. A., Editor of The Mathematical Gazette, Stroud, England.

$$\text{Prove } \Sigma \cos^4 x - 2\Pi \cos^2 x + 2\Pi \sin^2 x = 1 - \sin(\Sigma) \sin \Pi(y+z-x).$$

Solution by G. B. M. ZERR, A. M., Ph.D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa.

$$\sin(\Sigma) \sin \Pi(y+z-x)$$

$$= \sin(x+y+z) \sin(x+y-z) \sin(z-y+x) \sin(z+y-x)$$